

Critical Electrical Infrastructure Upgrade for Primary Data Center, Metro Nashville Public Schools

Nashville, TN



Electrical room

Due to increased demand and growth, Metro Schools' needed to expand their data center's critical electrical infrastructure to meet future needs. Puckett Engineering's solution began with an initial study to evaluate the feasibility, design alternatives, and estimated construction costs for upgrading the data center's emergency power and UPS systems to accommodate the data center's estimated growth rate. As a result of the study and collaboration with Metro Schools, Puckett Engineering's solution for a reliable, efficient, and cost effective critical infrastructure included the following:

- Architectural design for converting existing office space into an electrical room for housing the main switchgear and UPS systems.
- Architectural design for replacing and modifying walls around the data center in order to provide fire rated walls around the data center.
- Site limitations required close proximity between the utility service transformer and the outdoor emergency generator. Therefore, the architectural and structural design included creating a 4-hour fire barrier between the utility transformer and generator.
- Replacing the electrical service with a new pad-mounted transformer and underground primary and secondary feeders.
- Replacing the emergency generator and 2N redundant UPS systems with larger systems (500kW/625kVA generator and 225kVA UPS systems).
- Surge protection for the power system and for the data and signal wiring between the generator and indoor components.
- Electrical equipment design and wiring for control and mitigation of power system harmonics caused by the UPS systems and nonlinear electronic loads.

PROBLEM OR NEED

Data Center's critical electrical infrastructure undersized due to increased growth and demand.

PUCKETT SOLUTIONS

Replacing emergency generator and redundant UPS systems with 500kW/625kVA generator and 225kVA UPS system.

Replacing the electrical service with new pad-mounted transformer and generator.

Architectural design to convert office space into electrical room for main switchgear and UPS systems. Also added or modified fire-rated walls.

Added 4-hour fire barrier between utility transformer and generator.

Surge protection.

Mitigation of power system harmonics.

Network interface for monitoring alarms and status conditions for generator, UPS and UPS room A/C.

Minimized interruptions during construction.

Year Completed: 2010

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New emergency generator, pad-mounted transformer, and firewall



Identification and labeling of circuits

- Network interface for the generator, UPS, and, UPS room A/C systems was incorporated for monitoring alarms and status conditions via the local area network.
- Digital metering at power distribution equipment.
- The data center's emergency-power-off controls were upgraded to incorporate the new UPS systems.
- Grounding for safety, lightning protection, and control of static electricity.
- Fault current, coordination, and arc flash studies.
- Identification of all electrical and mechanical equipment and critical circuits in order to readily identify equipment and devices and know where they feed from. In addition, color coding of nameplates were utilized to quickly identify whether a circuit is supplied from emergency, UPS, or normal power.
- A clean-agent fire suppression system was included for protecting the new electrical (UPS) room.
- Computer room (Precision) type A/C unit for the UPS room.
- Structural design of concrete pads for supporting the new generator, utility transformer, and A/C condensing unit.
- Steel bollards and a roadway guardrail were included in the design for protecting the outdoor equipment.
- Special considerations were incorporated into the design for minimizing any negative impacts on the facility's aesthetics.
- Special considerations were incorporated into the design for maintaining daily operations and minimizing power interruptions during the work.
- Due to budget concerns, the project included multiple add-alternates within the bid documents.

Construction administration services were also provided, including commissioning and closeout documentation. Currently finalizing recommended preventative maintenance and periodic re-commissioning.

Critical Mechanical Infrastructure Upgrade for Primary Data Center, Metro Nashville Public Schools Nashville, TN

Due to increased growth, Metro Schools' needed to expand their data center's critical mechanical infrastructure. Puckett Engineering's solution began with an initial study to evaluate the electrical system and emergency generator to accommodate upgrading of the data center's UPS and mechanical systems. Puckett Engineering's solution for upgrading their critical infrastructure with limited funding included the following steps (electrical upgrades were postponed until a later project):

- Due to limited funding, the emergency generator could not be upgraded at this time. Therefore, load-shed and other control interfaces were incorporated as described below.
- The main distribution panel required replacement to accommodate additional circuit breaker space.
- Replaced one of two UPS systems with a larger system in order to provide a 2N redundant UPS configuration.
- Surge protection for the power system.
- Replaced the data center CRAC units with larger units to accommodate for the existing demand and future growth.
- Replaced the backup air conditioning unit with a larger unit. Due to capacity limitations on the electrical service and generator, control interface was incorporated to prevent more than two of the three air conditioning units from operating at the same time.
- Due to capacity constraints on the existing emergency generator, control interfaces were designed for load-shedding when loads were supplied from the emergency generator. For example, the reheat and humidification on the CRACs were disabled and the UPS battery charging was reduced.
- The design incorporated distribution equipment and wiring for control and mitigation of power system harmonics caused by the UPS systems and nonlinear electronic loads.
- Fault and coordination studies.
- Identification of all electrical and mechanical equipment and devices in order to readily identify equipment and devices and know where they feed from. In addition, color coding of nameplates were utilized to quickly identify whether a circuit is supplied from emergency, UPS, or normal power.
- Network interface with the UPS and A/C systems was incorporated for monitoring alarms and status conditions via the local area network.
- The data center's emergency-power-off controls were upgraded to incorporate the new UPS and A/C systems.
- The design was implemented in phases on a fast-track basis.
- Special considerations and coordination during design and installation were included for maintaining daily operations and minimizing power interruptions during the construction work.
- Construction administration services were also provided, including commissioning and closeout documentation.

PROBLEM OR NEED

Data Center's critical infrastructure inadequate to handle future needs. School system strapped with limited funding.

PUCKETT SOLUTIONS

Devised cost-effective solutions to enhance reliability and redundancy.

Replaced main distribution panel.

Replaced one UPS system with larger system to provide 2N redundant level.

Increased size of data center CRAC units.

Replaced backup A/C unit with larger unit and installed control interface to prevent overload of system.

Incorporated load-shedding to allow reliable and redundant operations without overloads at critical times.

Fast-track construction with minimal interruptions.

Included construction administration and commissioning.

Year Completed: 2007
